RESEARCH DEPARTMENT

INVESTIGATION OF POOR RECEPTION FROM CRYSTAL PALACE IN THE REIGATE AND HORSHAM AREAS

Report No. K-117

(1956/34)

THE BRITISH BROADCASTING CORPORATION
ENGINEERING DIVISION

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SUMMARY.

An investigation has been made into complaints of poor reception, in the Reigate, Redhill, Crawley and Horsham districts, of the Crystal Palace television transmitter installation, in its temporary condition.

The field strength in these areas is lower than the values predicted from site test measurements and the prevalence of flutter fading due to aircraft is abnormally high. It is concluded that the cause is due to the screening effect of the main mast now being constructed which subtends an arc including these areas. Field strength measurements of radiation from the interim aerial on the high mast have confirmed these conclusions.

1. INTRODUCTION.

Shortly after the London television service was taken over by the temporary (200 ft (61 m) aerial, 47 kW e.r.p.) Crystal Palace installation, Engineering Information Department received complaints of poor reception in Reigate, Redhill, Crawley and Horsham. It was stated, and confirmed by a visit to the area by an Engineering Information Department engineer, that while the field strength was substantially the same as that provided by Alexandra Palace, the picture was subject to much more flutter (fading of the type normally associated with the movement of aircraft) than it had been when the transmission came from Alexandra Palace. It was also stated that on many occasions flutter was observed when there was no aircraft in the vicinity—— implying that some other agency was responsible for the flutter.

Measurements were therefore made of the field strength in these towns and observations made of the flutter fading on reception of both Alexandra Palace and Crystal Palace in Horsham.

2. RESULTS.

2.1. Median Field Strength Values.

The field strength in Reigate, Redhill, Crawley and Horsham from the Alexandra Palace and Crystal Palace (temporary condition) transmitters is given in Table 1, from which it will be seen that, with the exception of Horsham, all of the towns receive substantially the same field strength from both transmitters.

TABLE 1

Town	Median Field Strength in dB ref. 1μV/m 30 ft (9·2 m) AGL Alexandra Palace	Crystal Palace	Ratio (dB) Crystal Palace/Alexandra Palace
Reigate, Redhill	50	48	−2
Crawley	51	52	+1
Horsham	42	37	−5

The field strength from Crystal Palace is, however, very considerably less than the value expected from site test measurements. This is clearly shown in Table 2.

TABLE 2

Town	Median Field Strength in dB ref. 1μV/m 30 ft (9·2 m) AGL Derived from Site Test Measurements (Expected)	Realised	Ratio (dB) Realised/Expected
Reigate, Redhill	64	48	−16
Crawley	58	52	−6
Horsham	48	37	−11

Fig. 1 shows the values obtained in other directions from the transmitter compared with the predicted values. These figures indicate that the self-supporting tower now being constructed about 300 ft (92 m) distant from the temporary aerial and in the direction of the affected areas is causing serious screening.

2.2. Theoretical Considerations.

The axis of the tower is 290 ft (89 m) from the temporary aerial on a bearing of 208·5°. Two sides of the tower are approximately parallel to this bearing.

The tapering form of the tower will be ignored and the cross-section at the level of the temporary aerial will be regarded as applicable to all levels. This approximate procedure can be justified by the method of stationary phase.

The tower is of open lattice construction, most of the members being either approximately horizontal (and hence having little effect) or located in the vicinity of the four main legs.

The shadowing effect has been computed by two methods.

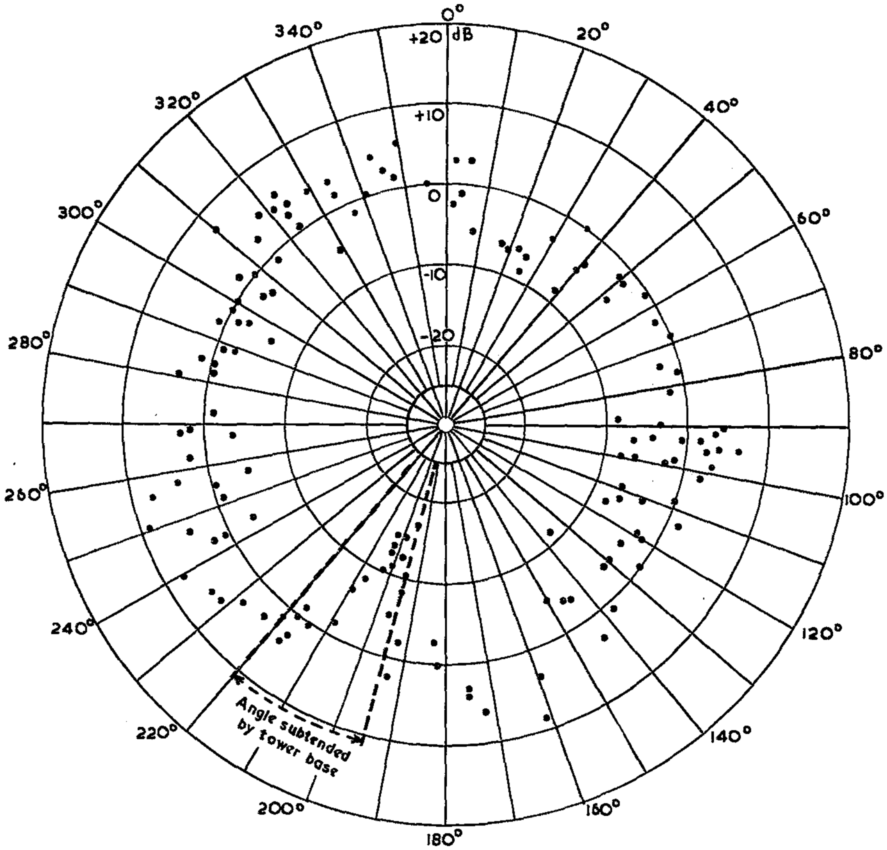

Fig. 1 - Crystal Palace, temporary condition. Ratio of realised to expected field strength in different directions

2.2.1. Method 1.

This was thought to be the best approximation practicable. Each of the four legs, together with the lattice members grouped in its vicinity, was regarded as equivalent to a cylinder 6 ft (1·8 m) in diameter. The axes of the four cylinders pass through the corners of a 46 ft (14 m) square. The currents excited in the cylinders were computed, ignoring the non-uniformity of the distribution of current round the periphery of each cylinder (this approximation is known to be quite accurate for cylinders of this diameter).

2.2.2. Method 2.

The tower was treated as a perfect screen 55 ft (17 m) in width and its effect was computed by classical diffraction theory. This approach was intended to set an upper limit to the shadowing effect.

The results obtained by these methods are compared with the measured results in Fig. 2. It will be seen that the measured reduction in field strength in the vicinity of the optical shadow corresponds in order of magnitude with the results obtained by Method 2.

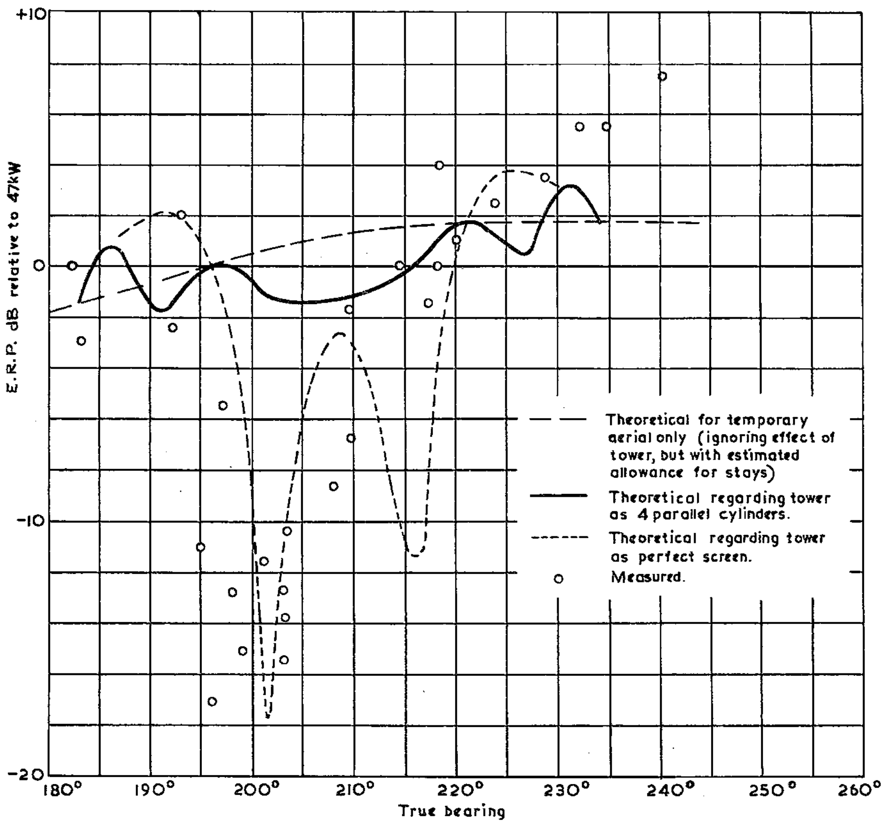

Fig. 2 - Comparison between theoretical and experimental results for shadowing effect

2.2.3. Discussion of Results.

Although the treatment of the tower as four parallel cylinders is an approximation, it was at least expected that it would show the correct order of magnitude of the shadowing effect. It is thought that the discrepancy was occasioned by a large number of steel wire ropes suspended from the tower to facilitate erection. A few days after the field strength measurements had been made, no less than 17 wire ropes were counted, some hanging more or less vertically inside the tower and others being draped round the outside.

2.3. Observations in Horsham.

The pictures received from Alexandra Palace (special Test Card 'C' transmission) and Crystal Palace were monitored for two consecutive half-hour periods on a commercial television receiver while the field strength was recorded on a Pegelschreiber chart.

As observations could be made on only one transmission at a time the results are necessarily based on the assumption that aircraft movement was random. The ratio of the amplitude of the aircraft reflected component to that of the mean signal for each transmission is plotted against percentage time in Fig. 3.

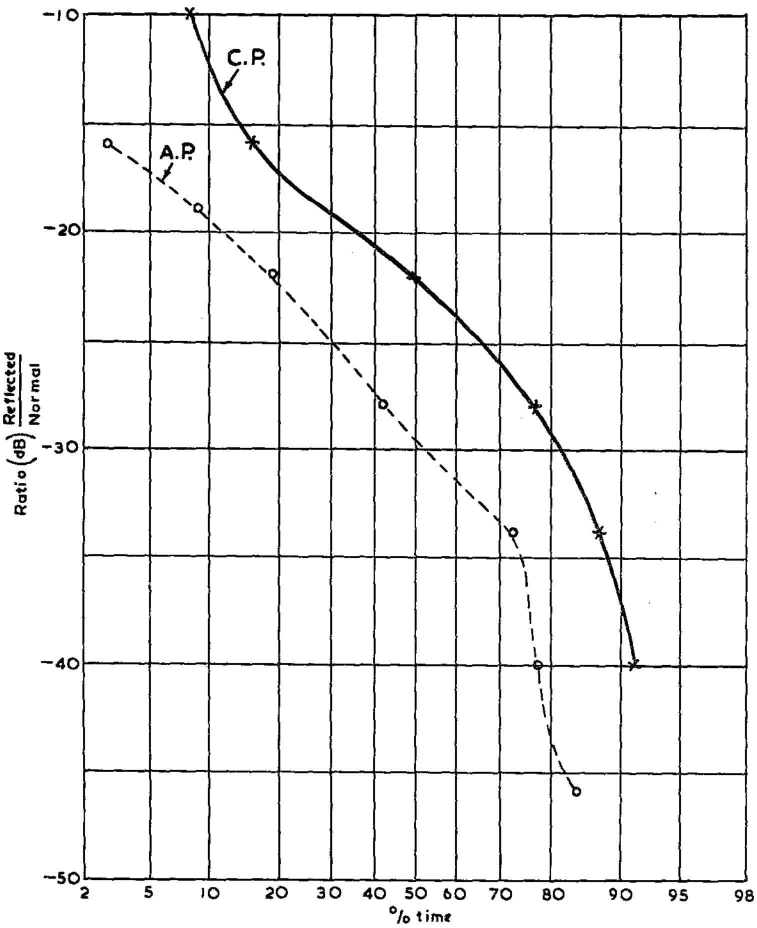

Fig. 3 - Investigation of poor reception in Horsham

The ratio was sampled at 30 second intervals for each 30 minute test transmission and it will be seen that the amplitude of the aircraft reflected component relative to the mean signal level was 6–14 dB greater for the Crystal Palace transmission than for the Alexandra Palace transmission. The non-linearity of the curves indicates that aircraft movements were not random, owing to the short test period.

3. CONCLUSIONS.

The field strength in the Reigate, Redhill, Crawley and Horsham areas of the Crystal Palace television transmitter using the temporary aerial 200 ft (61 m) above ground level is as much as 16 dB less than that predicted from site test measurements and is rather less than that provided by Alexandra Palace. An effect associated with this reduction in field strength is the greater degree of flutter fading due to aircraft. The reception tests at Horsham confirm that flutter fading is much worse on the Crystal Palace transmissions than it was when Alexandra Palace provided the service. Subjectively the flutter is exceedingly annoying and occasionally the picture at Horsham breaks up.

Flutter was often observed when aircraft could neither be seen nor heard but the field strength records show that it is of the type normally associated with the random movement of aircraft. The chart also shows that two or more aircraft often cause flutter simultaneously.

The abnormally high degree of flutter experienced in the affected areas and the low field strength is caused by the proximity of the tower at Crystal Palace to the temporary aerial as subsequent tests have proved. This tower causes serious attenuation of the signal in the direction of the affected areas but aircraft in the neighbourhood of these areas are clear of the screening effect of the tower. The net result is that the aircraft reflected component is some 6–14 dB stronger when the transmission is from Crystal Palace with a consequent serious degradation in the service.

Field strength measurements, which have not been included in this report, have now been made on transmissions from the high mast in the areas concerned. These measurements confirm that the low fields and the high degree of aircraft flutter were due to screening by the high mast.

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